

REPORT

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SUPPLEMENT TO
REPORT NO.

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scribed below on a 14 mm $\frac{1}{2}$ " reach spark plug of German manufacture which was purchased in Finland during early 1950. The plug, which bears the marking MC 8-14/175 was made by Porzellanwerk Neuhaus, Neuhaus-Schierschnitz, in Kreis Sonneberg/Thuringen, Sovzone, Germany.

1. Examination of the spark plug has revealed the following:
 - (a) In appearance and general construction the subject spark plug bears a decided resemblance to the general line of ceramic spark plugs manufactured by Bosch.
 - (b) The shell seal utilized a compensating expansion member crimped under the shell lip as per Bosch practice. The center seal utilizes an aluminum gasket under the terminal stud as per Bosch practice and the general insulator and shell design is typical of the well-known German manufacturer of spark plugs. The Neuhaus M3 8-14/175 is a $\frac{1}{2}$ " reach, 14 mm design as commonly used in Europe for automotive applications.
 - (c) The general design and construction of the spark plug are along Bosch lines; however, some very important differences are obvious. The shell seal employed is similar to that employed by Bosch with the exception that the upper and lower shoulder gaskets are solid copper instead of copper-asbestos as per Bosch practice. From the results of the pre-ignition test and the known performance of Bosch plugs it would appear that with this type of shell seal, some form of resilience is necessary for best results; the Neuhaus spark plug lacks this feature.
 - (d) The center electrode seal in the Neuhaus plug is by means of cement and a calked aluminum gasket at the terminal screw.
 - (e) Attention is called to the fact that the center electrode consists of a short length of tungsten braced to a length of copper wire; the copper wire being formed in a series of steps on opposite sides and the upper end of the whole electrode fitting loosely into a hole drilled in the terminal screw. This construction obviously is aimed at conserving the metal used in the electrode tip and in keeping the temperature of the tip as low as possible. However, it has two serious drawbacks, (1) copper is exposed to combustion products and under severe operating conditions would be subject to rapid erosion and (2) the whole center electrode construction is retained in the insulator bore by means of cement alone and if the cementing operation were poorly performed, there would be a distinct possi-

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bility that this part would move and short out against the side electrode, or what would be much more serious, fall into the engine cylinder. This construction is a radical departure from that employed by Bosch.

- (f) The shell was judged to be well machined and of good finish except for the threads which appear to be die-cut and ragged in finish.
- (g) The designation "14/175" is believed to indicate a 14 mm plug with an IMEP [Indicated Mean Effective Pressure] rating of approximately 175 and would indicate that ETL [Ethyl Test Laboratory Engine] -- a variable compression, single-cylinder engine now adopted by all U.S. spark plug manufacturers for making standard tests -- engines are available in Germany and that the SAE [Society Automotive Engineers] rating method has been adopted. Inspection of the end of the shell shows a small counterbore which would be ^asecondary operation on an automatic screw machine and which appears to serve the purpose of correcting for small changes in rating which may result from the use of different insulator materials.
- (h) The insulator is well designed.
- (i) The external seat gasket supplied with the subject plug is made of steel and though poorly formed, would appear to be adequate for the purpose.
- (j) Available on loan from the CIA Graphics Register are the following four photographs of this spark plug:
 - (1) General appearance of plug
 - (2) Insulator assembly and shell seal parts
 - (3) Insulator and center electrode assembly
 - (4) External seat gasket

2. The results of tests and analyses performed on the Neuhaus plug are as follows:

- (a) Prior to a pre-ignition test in the 17.6 cubic inch ETL engine the subject spark plug was checked for leakage at 225 psi. The shell leakage was found to be 2.0 cc/min. and the center electrode leakage was 0.0 cc/min. The plug was dielectrically sound as checked on our flash-over type dielectric tester (Tesla coil circuit).
- (b) The pre-ignition rating of the Neuhaus MC 8-14/175 spark plug was found to be 189 IMEP using the SAE test method. For a direct comparison two Auto-Lite AE-6 $\frac{1}{2}$ " reach, 14 mm spark plugs were rated before the Neuhaus plug; the average rating being 187.8 IMEP. After the pre-ignition test the Neuhaus spark plug was again checked for gas leakage and to determine whether it was dielectrically sound. The gas leakage at 225 psi was found to be 20 cc/min. at the shell seal and 0.0 cc/min. at the center electrode. The plug was found to be dielectrically sound using the flash-over tester.
- (c) The shell material was found on analysis to be a chrome-manganese steel similar to SAE 5115. The reason for using a steel of this type which does not have good machining characteristics is unknown. The actual analysis of the steel is as follows:

Carbon	.15 per cent
Manganese	1.14
Phosphorus	.023
Sulphur	.042
Nickel	.27
Chrome	.84
Molybdenum	.00

- (d) The Rockwell hardness test of the shell ranged over the following hardness numbers:

84 - 92 R/B

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- (e) The side electrode stock was found to be nickel-manganese alloy containing 1.93 per cent manganese. 25X1A
- (f) The composition of the insulator was found to be approximately 90 per cent alumina; the grain size is larger than in American practice being found to average 18 microns. The bond between the alumina grains was found to be siliceous glass. The characteristic pink color is due to a solid solution of chromic acid with the alumina. Judging from the grain size, this material is believed to be an electric furnace product and is generally of high quality though probably with lower physical properties than alumina bodies generally used in the USA.

3. The evaluation of the Neuhaus plug is as follows:

- (a) On the basis of the single plug available and the one pre-ignition rating test conducted it would appear that the shell seal in the subject plug, in spite of its similarity to the Bosch design, was unsatisfactory for the purpose. With few exceptions, any one-piece shell seal spark plug made in the US today can be run through a pre-ignition test on the ETL engine without developing any measurable shell leakage whatsoever.
- (b) The construction of the center electrode has two serious drawbacks in that copper is exposed to combustion products and would be subject to rapid erosion under severe operating conditions, and the whole center electrode construction is retained by cement alone; and there is a distinct possibility that the part could move and short-circuit, or fall into the engine cylinder where it might cause considerable damage.
- (c) The shell was machined from unsuitable steel.
- (d) The side electrode was inserted into a hole in one side of the shell and peened in place. This method of retaining the side electrode has become obsolete in the USA because it affords poor heat transfer; welding at this point is employed almost universally in the USA.
- (e) The plug marking reveals the probability that ETL engines are available in the Sovzone and that the SAE rating method has been adopted.
- (f) The materials used in the plug are generally of high quality and the workmanship is good.
- (g) There are several features of the design of the plug which appear to be hazardous and inadequate for the purpose.
- (h) In the writer's opinion, the plug would give satisfactory service in passenger cars, but would be inadequate for severe truck or commercial use.

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TYPE MC 8-14/175

PORZELLANWERK NEUHAUS

NEUHAUS-SCHIERSCHNITZ, GERMANY



GERMANY

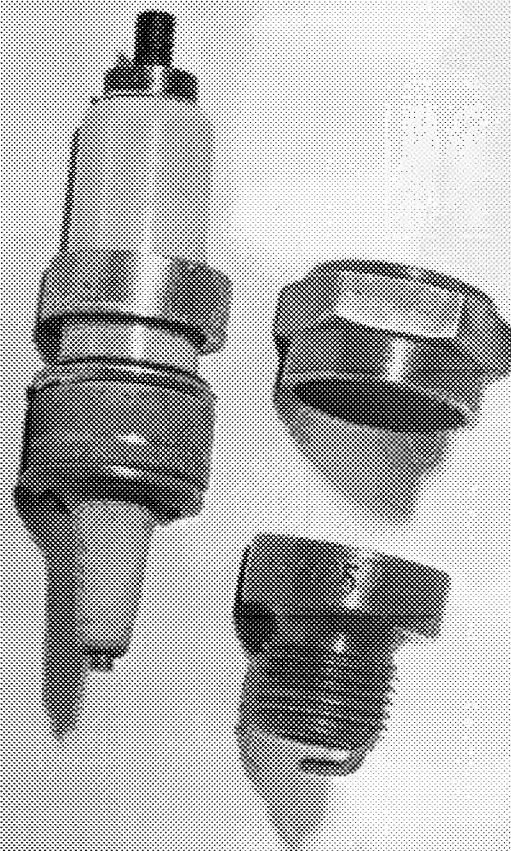
14mm $\frac{1}{2}$ " reach spark plug made by Porzellanwerk Neuhaus,
Neuhaus-Schierschnitz, in Kreis Sonneberg/Thuringen. Purchased by
Finland during early 1950.

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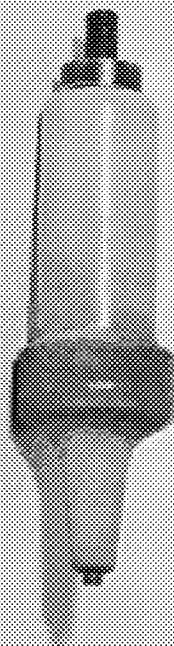
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INSULATOR ASSEMBLY AND SHELL SEAL PARTS

GERMANY
14mm 4" reach spark plug, Type K28-14/175 made by Porzellanwerk Neuhaus, Neuhaus-
Sohlerschnittz, in Kreis Sonneberg/Thuringen. Purchased by Philand during early 1950.
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INSULATOR AND CENTER ELECTRODE ASSEMBLY



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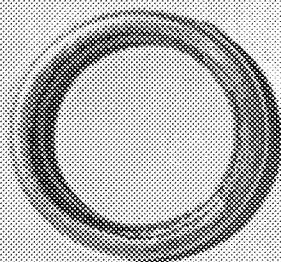
GERMANY
14mm in reach spark plug, Type MB8-14/175 made by Porzellanwerk Neuhaus, Neuhaus-
Bellerschmittz, in Kreis Sonneberg/Thuringen. Purchased by Finland during early 1960.
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Gasket supplied with
Spark Plug Type MC 8-14/175

Porzellanwerk Neuhaus
Neuhaus-Schierschnitz, Germany



GERMANY

Gasket supplied with 14mm $\frac{1}{2}$ " reach spark plug made by Porzellanwerk
Neuhaus, Neuhaus-Schierschnitz, in Kreis Sonneberg/Thuringen.
Purchased by Finland during early 1950.

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